'Guppy Disease…… One to Avoid!'

Foreword

For the purpose of this article I have generically grouped infections from *Tetrahymena* under the title of *Tetrahymena* spp. The two terms, '*Tetrahymena* infection' and '*Tetrahymena* spp.' have been used interchangeably. *Tetrahymena pyriformis* is the predominant species although other species are associated with infection.

Accurate identification of *Tetrahymena* spp. presents a challenge for even the most experienced proto-zoologist. This involves the use of complex staining techniques to identify the cortical features. Studies based on *Tetrahymena* spp. have occurred over the past few decades. More recently, genetic analysis has been used to classify *Tetrahymena* spp.

There are many species within the genus *Tetrahymena*, certain species have changed names due to recent advances in molecular work and re-classification of the group is ongoing.

Background

If ever there was an award for 'protozoa with the best adaptive lifestyle' it would have to be presented to *Tetrahymena* spp.

This ciliated protozoan can alternate between free living, commensal and parasitic modes of survival. It is the causative agent of **Guppy Disease** (Glass, S) also referred to as **Guppy Killer Parasite** (Pimenta Leibowitz, 2005). The common names do not sound terribly pleasant and in many respects it lives up to its name, it is relentless and menacing when left untreated.

Many types of tropical and cold water fish are susceptible to infection and amphibians can act as vectors for the disease.

Tetrahymena spp. are distributed worldwide in almost any type of freshwater body. From the cleanest rivers and lakes to stagnant roadside ditches and waste water treatment works.

There are reports of *Tetrahymena* infections in commercial guppy farms in the far-east and Israel (Pimenta Leibowitz, 2005)

When *Tetrahymena* is in a free living state it grazes on bacteria and organic particulate matter, it can be cultured artificially in proteose-peptone medium.

As a commensal it will graze on dead skin cells, bacteria and organic matter on the mucus layer of the fish without causing any harm.

It is when *Tetrahymena* numbers increase significantly that problems become more evident. If there are breaks in the skin *Tetrahymena* will revert to an opportunistic pathogen and burrow into the musculature of the fish (Glass, S). In many cases the infection becomes

systemic entering the bloodstream and further infection occurs far from the point of entry. Mortalities can reach high levels, with young fry being more susceptible than adults.

Within the area of parasitology, there are complex relationships between host and parasite. This is often referred to as the equilibrium between the host and parasite. Whenever the host dies, the equilibrium balance is no longer in favour of the parasite, therefore it leaves in search of a new living host.

Unlike other parasites, *Tetrahymena* spp. are the exception to the rule. They thrive on the dead host by continuing to feed on organic matter and the bacteria involved in decomposition of the fish.

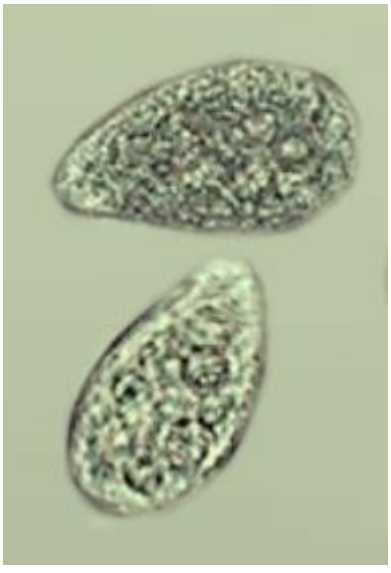
Literally, innumerable specimens of *Tetrahymena* will be present on the dead host.

Manifestations of the disease are attributed to poor nutrition, poor water quality, high organic content, overcrowding and stressed fish. These conditions are not always a pre-requisite for the disease to become established. Infections from *Tetrahymena* can occur in under stocked tanks with relatively good water conditions.

Many universities and research institutions involved in zebra fish (*Danio rerio*) research use cultured *Tetrahymena* strains for feeding fry instead of Paramecium.
These *Tetrahymena* strains are reported as harmless, however mutations of the protozoa can and will occur, *Tetrahymena* should be avoided at all cost.

Identification

Fish infected with *Tetrahymena* usually appear to be lethargic showing clamped fins and a loss of appetite. Various sources suggest smallish white spots on the fins and sides, similar to whitespot, however, from my own observations with *Tetrahymena* this is not always evident.



A gross observation of dead fish or fry infected with *Tetrahymena* will appear as very pale specimens. Usually, but not always the dead fish will exhibit exophthalmos and occasional abdominal swelling.

For a more accurate assessment a low powered microscope is essential.

Tetrahymena spp. are approx 50-90 μ,m and magnification (x 40) is required.

It is possible to observe *Tetrahymena* spp. from skin scrapings from larger fish, or dead fry can be mounted under the microscope.

Tetrahymena spp. are pear or egg shaped with a slightly pointed anterior, swarms of the protozoa can occur covering the outer surface of the skin. The picture shows the typical shape of Tetrahymena when viewed using phase contrast microscopy.

Treatment

Due to the diverse nature of *Tetrahymena* spp. they are very difficult, almost impossible to eradicate.

Proprietary chemical treatments for protozoan diseases have varying degrees of success but only appear to reduce parasite numbers. If the onset of infection is at the systemic stage, then external treatments are virtually useless. I have used a variety of chemical treatments in the past with no sign of improvement even after prolonged usage. If anything, dip treatments at higher concentrations seem to achieve the best results, however, such treatments are harsh and stressful for fish.

Personally, I prefer not to use chemical treatments, only as a last resort. One alternative approach I adopted was to use salt baths (salt without iodine) at 3% strength for 10-15 minutes. I had previously used 1% salt baths, however infection was still prevalent after such treatment.

Removing *Tetrahymena* from the tank presents a challenge in itself. There is the option of completely drying out the tank, this will destroy any living *Tetrahymena* spp., it is also a time consuming and a labour intensive process.

A common phenomenon for removing parasites from an infected tank is to 'fallow' the tank for an extended period. This involves removing all fish and creatures that would act as a host. By doing so the parasite has no means of survival without its host. Unfortunately, with *Tetrahymena* parasites they simply revert to their free living stage and continue to grow quite happily without a host.

Tetrahymena spp. exist over a wide temperature range from around 5^{o}C to upper 30's ^{o}C.

The optimum temperature for growth and reproduction for some of the *Tetrahymena* spp. is 28^{o}C (Sleigh, 1973).

What's interesting is that *Tetrahymena pyriformis* only reproduces in the range 7.5^{o}C - 32.5^{o}C (Sleigh, 1973). By heating the water to 33^{o}C this prevents the protozoa from multiplying, however they will still be present at this temperature. There are no published definitive trials for the lifespan of these protozoa at 33^{o}C but it is only a matter of time before numbers start to decline. Around 5 days at this temperature, combined with water changes to remove excess organic matter should successfully eradicate the infection.

Obviously, some of these treatments will have drawbacks and may not be practical for controlling the disease. Fish might not tolerate high temperature or salinity levels and some submersible heaters will fail to heat the water to 33^{o}C. In some cases a space heater or industrial heater will be required to raise the temperature that extra degree or two.

Future Precautions

It has often been said that the best form of managing any disease is to buy disease free stock. Only obtain fish from a reputable breeder or supplier. The same can be said whenever purchasing plants, live foods and exchanging aquarium decor such as gravel from one tank to another.

If you are able to, try to source fish that are locally bred. Fish reared in tap water will be more hardy to your water conditions, less stressed and less likely to harbour *Tetrahymena* parasites.

Referring to an article by Dr. P. Burgess in PFK magazine, I can only reiterate the importance of quarantine for any newly acquired fish.

As far as I am aware (at the time of writing Nov 2007), *Tetrahymena* is not listed as a notifiable disease, therefore health officials do not have to declare its presence when signing off health certificates for exported fish.

Despite the low profile of *Tetrahymena* it can lead to devastating mortalities in fish stocks. All fish should be quarantined on arrival, followed by close observation and treated accordingly.

The issue of biosecurity should also be addressed. Disinfection of infected nets and equipment such as pumps and siphon hoses should be carried out on a regular basis and after each use.

References

Burgess, P. Dr, (2007) Practical Fishkeeping Magazine, May Issue

Glass, S. Aquarium Quarterly - Guppies (YB-032), T.F.H. Publications

Pimenta Leibowitz, M. *et al* (2005) Environmental and Physiological conditions affecting *Tetrahymena* sp. infection in guppies, *Poecilia reticulata* Peters. Journal of Fish. Dis. 2005, 28, 539-547

Sleigh, (1973) 'The Biology of Protozoa'

Acknowledgements

Personal communication, Fish Diseases Unit, Agri-Food and Biosciences Institute, (Formerly Dept. Agriculture and Rural Development)

Glossary

Commensal - an organism participating in a symbiotic relationship in which one species derives some benefit while the other is unaffected.

Exophthalmos - protruding/swollen eyes due to infection or inflammation

Fallow - adopted from agricultural terms, land left unseeded during a growing season, same application in aquatic terms, to leave barren or uninhabited.

Protozoan - Any of a large group of single-celled, usually microscopic, eukaryotic organisms, such as amoebas, ciliates, flagellates, and sporozoans. Plural is either protozoa or protozoans

sp. - single or individual species

spp. - more than one species, many species

To submit your questions and comments to the author: david.rodgers_ni@yahoo.co.uk